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71 Applicant: **BROTHER KOGYO KABUSHIKI KAISHA**
15-1, Naeshiro-cho, Mizuho-ku
Nagoya-shi, Aichi-ken (JP)

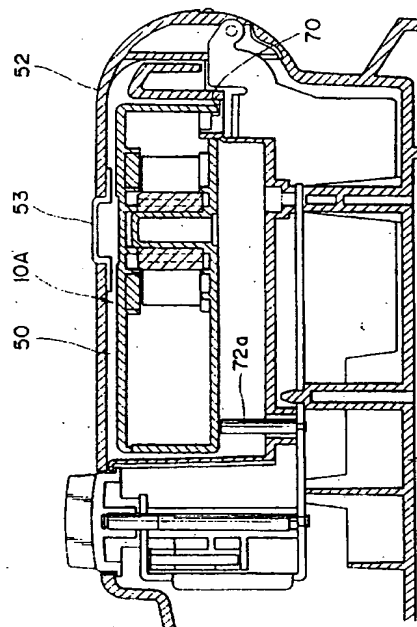
72 Inventor: **Yamaguchi, Koshiro, c/o Brother Kogyo K. K.**
15-1 Naeshiro-cho, Mizuho-ku
Nagoya-shi, Aichi-ken (JP)
Inventor: **Nagao, Yoshiaki, c/o Brother Kogyo K. K.**
15-1 Naeshiro-cho, Mizuho-ku
Nagoya-shi, Aichi-ken (JP)

74 Representative: **Senior, Alan Murray et al**
J.A. KEMP & CO., 14 South Square Gray's Inn
London WC1R 5LX (GB)

54 **Printing device.**

57 In a cassette accommodation chamber (50) of a printing device (40), a cassette (10) accommodating at least one tape-like member (18, 22, 26) is detachably receivable. The cassette accommodation chamber has a bottom surface and an entrance opening opposite to the bottom surface. In the accommodation chamber, cassette receiving members (70, 72) are provided for receiving the cassette in such a fashion that, if a relatively thin cassette (10A) (containing a narrow tape-like member) is received in said accommodation chamber, the thin cassette is positioned away from the bottom surface of said accommodation chamber. Namely, the cassette is positioned such that the uppermost surface of the cassette is positioned at the substantially same position regardless of the thickness of the cassette.

FIG. 3



The present invention relates to a printing device suitable for printing images, such as alphanumeric characters, onto a tape-like recording medium accommodated in a tape cassette.

Previously there has been proposed a tape printing device for creating a tape by printing reversed images of characters and the like on the backside of a transparent tape, and adhering a double-sided adhesive tape provided with a release paper to the transparent tape. The thus created tape may then be used as an index and the like, for example by being adhered to the backside of a video cassette or the like.

In this kind of printing device, the tape cassette is exchangeably mounted. There are often various different types of tapes having various widths ranging from narrow to wide. It is advantageous if the device can accommodate cassettes containing narrow and wide tapes. For this purpose, by providing a deep cassette accommodation unit, both thick and thin tape cassettes can be accommodated. However, in such a construction, a thin tape cassette (containing a narrow tape) is accommodated in the base of the tape accommodation unit. As a result, the print head of the printing device extends through the tape cassette and projects upwardly beyond the upper surface of the cassette. This is disadvantageous in that a user's hand may contact the print head and stain the surface of the print head. Furthermore, in needing to provide an opening in the upper surface of a thin tape cassette so that the print head may pass therethrough, the tape or tapes in the cassette are exposed. This can also cause problems in that the user's hand may inadvertently touch the tape or tapes contained in the cassette through the opening and stain them.

According to a first aspect of the present invention there is provided a printing device comprising a cassette accommodation chamber in which a tape cassette, containing a tape-like member, is detachably receivable, said cassette accommodation chamber having a bottom surface and an entrance opening opposite to said bottom surface and said cassette accommodation chamber being arranged to receive tape cassettes of at least two different thicknesses, said printing device further comprising cassette positioning means provided in said cassette accommodation chamber for cooperating with a cassette received in said chamber to position the received cassette in said chamber, wherein when the received cassette is the thinner of said at least two different thickness tape cassettes a base surface of the thinner cassette facing said bottom surface is spaced from said bottom surface by a greater amount than the spacing between said bottom surface and the corresponding base surface of the thicker of said at least two different thickness tape cassettes when the thicker tape cassette is the received cassette.

This provides an improved tape cassette mounting structure of a printing device, by which either a

thin tape or a thick tape cassette can be used, and even if the thin tape cassette is used, staining of a print head surface and/or damage to the tape(s) in the cassette can be substantially prevented.

According to another aspect of the present invention there is provided a cassette for use with the printing device in accordance with the above-mentioned first aspect of the present invention, the cassette comprising means arranged to cooperate with the cassette positioning means of the printing device, when the cassette is received in the cassette accommodation chamber, to position the cassette, the arrangement of these cooperating means being dependent on the thickness of the cassette.

According to a yet further aspect of the present invention there is provided a tape cassette for use with a tape printing device, the cassette being arranged, in use, to be received in a cassette accommodation chamber of the printing device, the tape cassette comprising a case, a tape-like member contained in the case and means for positioning the cassette in the cassette accommodation chamber, the orientation of said means for positioning being dependant on the thickness of the cassette and being selected whereby regardless of the thickness of the cassette the surface of the cassette that is arranged, in use, to face out of the cassette accommodation chamber is positioned in substantially the same location as the corresponding surface of another cassette of different thickness when the another cassette is received in the same cassette accommodation chamber.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a plan view of a tape cassette suitable for use in a printing device embodying the present invention from which almost all the portion of an upper cover of the cassette case is shown as removed;

Fig. 2 is a perspective view of a cassette accommodation unit of the printing device of Fig. 1, suitable for receiving the cassette of Fig. 1;

Fig. 3 is a cross sectional view showing a thin tape cassette received in the cassette accommodation unit of Fig. 2;

Fig. 4 is a cross sectional view showing a thick tape cassette received in the cassette accommodation unit of Fig. 2;

Fig. 5 is a cross sectional view showing the engaged state of an adhered tape feed/drive unit when a thin tape cassette is received in the cassette accommodation unit;

Fig. 6 is a cross sectional view showing the engaged state of an adhered tape feed/drive unit when a thick tape cassette is received in the cassette accommodation unit;

Fig. 7 is a cross sectional view illustrating an ink

ribbon winding/drive unit when a thin tape cassette is received in the cassette accommodation unit;

Fig. 8 is a cross sectional view illustrating an ink ribbon winding/drive unit when a thick tape cassette is received in the cassette accommodation unit;

Fig. 9 is a plan view of an embodiment of printing device in accordance with the present invention; and

Fig. 10 is a plan view of the cassette accommodation unit of the printing device of Fig. 9, showing the cassette accommodation unit closed by a cassette cover.

Fig. 1 shows the arrangement of a tape cassette 10 embodying the present invention.

The tape cassette 10 has a cassette case 16 composed of an upper cover member 12 and a lower case member 14 (in Fig. 1, almost all the portion of the upper cover member 12 is removed). Suitably and rotatably disposed in the cassette case 16 are:

a tape spool 20 around which a film tape 18 is wound;

a ribbon spool 24 around which an ink ribbon 22 is wound;

an adhesive tape spool 28 around which is wound a double-sided adhesive tape with a release paper 26 provided thereon with the release paper side facing outwardly; and

a ribbon winding spool 30 for winding the ink ribbon 22 fed from the ribbon spool 24.

A tape drive roller 34 is also rotatably disposed in the vicinity of a tape exit 32 opened at one side of the cassette case 16. The tape drive roller 34 feeds out a tape T, which, in the illustrated embodiment, is composed of the film tape 18 adhered to the double-sided adhesive tape 26, from the tape exit 32 in association with a tape feed roller 62 of a printing device to be described later.

The tape cassette 10 can be a thin tape cassette 10A or a thick tape cassette 10B. The case of the thin tape cassette 10A is comparatively shallow because the aforesaid film tape 18, ink ribbon 22 and double-sided adhesive tape 26 have a narrow width. The case of the thick tape cassette is deeper because the tapes have a wider width.

A printing device to which the tape cassette is suitable for coupling is shown in Figs. 9 and 10.

As shown in Fig. 9, the printing device 40 includes:

character input keys 42 for inputting characters and the like;

a print key 44;

a keyboard 46 on which various kinds of function key are provided;

a liquid crystal display 48 for displaying characters and the like input through the keyboard 46; and

a cassette accommodation unit 50 to which the

tape cassette 10 is to be attached. A hinged accommodation cover 52 is provided to cover an accommodation chamber for the tape cassette 10 at the rear portion of the printing device 40. The tape cassette 10 is attachable/detachable when the accommodation cover 52 is opened.

The cassette cover 52 is provided with a sight window 53 comprising a transparent plate. Through the sight window 53, tape width, tape color, amount of tape remaining of a tape cassette loaded in the cassette accommodation unit 50 may be visually confirmed.

Fig. 2 schematically shows the cassette accommodation unit 50.

In the cassette accommodation unit 50, a ribbon winding shaft 54 extends upwardly. The ribbon winding shaft 54 is rotatably driven by a pulse motor and is arranged to engage the ribbon winding spool 30 of the tape cassette 10 (when the cassette is received in the accommodation unit 50) to rotate the ribbon winding spool 30 in order to wind the ink ribbon 22 onto the spool 30. Further, a tape drive shaft 56 also extends upwardly and is arranged to engage with the tape drive roller 34 to rotate the same. The tape drive shaft 56 is engaged with a motor (not shown) through a gear transmission (not shown).

A thermal print head 58 and platen roller 60 are oppositely positioned and the tape feed roller 62 is arranged to cooperate with the tape drive roller 34 to feed the adhered tape T. Although not described in detail, the platen roller 60 and feed roller 62 are supported by a roller holder and are switchable between a print position and a release position by a switch mechanism (not shown). This switch mechanism may be as described in Japanese Patent Provisional Publication HEI 3- 283814 and accordingly a description thereof is omitted here.

The thermal print head 58 includes a plurality of heating elements for printing images, such as characters and the like, on the film tape 18 using the ink ribbon 22.

A tape cutter 64 is also disposed at a position adjacent to one side of the cassette accommodation unit 50 to cut the adhered tape T discharged from the tape exit 32 of the tape cassette 10.

The tape cutter 64 is composed of a fixed blade 66 and a movable blade 68. The fixed blade 66 is fixedly arranged at a position adjacent to the tape exit 32 and the movable blade 68 is movably positioned at a position away from the tape exit 32.

Although not described in detail, the mechanism for driving the tape cutter 64 transmits the drive force of a motor to the movable blade 68 through a gear mechanism to move the movable blade 68 about its fulcrum. Thus, the adhered tape T is cut off by the closing operation of the movable blade 68 in association with the fixed blade 66.

Step portions 70 are formed in the side walls of

the cassette accommodation unit 50. The step portions 70 are arranged to contact the outer base surface of the thin tape cassette 10A or an intermediate step portion of the wide tape cassette 10B, as shown in Figs. 3 and 4 respectively. In addition, projections in the form of receiving pins 72a, 72b extend upwardly from the inner bottom surface of the cassette accommodation unit 50 to contact and support the outer base surface of the thin tape cassette 10A. As shown in Fig. 3, when the thin tape cassette 10A is received in the cassette accommodation unit 50, it is horizontally supported on the upper side of the accommodation chamber of the cassette accommodation unit 50 by the step portion 70 and the receiving pins 72a, 72b in the accommodation chamber of the cassette accommodation unit 50. The spacing of the base surface of a cassette from the bottom surface of the cassette accommodation unit thus varies inversely to the thickness of the cassette. Consequently, the thin tape cassette 10A is received in the opening on the outer side of the cassette accommodation unit 50, enabling it to be easily attached/detached. In the illustrated embodiment, where the cassette accommodation unit is open at the top, the thin tape cassette is, in use, received in the upper portion of the accommodation unit 50. Further, when the thin tape cassette 10A is so mounted, the ink ribbon 22 is prevented from being caught by a print head 58 and damaged, and the surface of the print head 58 is prevented from being stained.

The bottom outer surface of the thick tape cassette 10B has recessed holes 74 into which fit the receiving pins 72a, 72b when the cassette 10B is received in the cassette accommodation unit 50 as shown in Fig. 4. In this case, the free or top end of each of the receiving pins 72a, 72b is abutted against the inner bottom surface of a recessed hole 74, and thus the thick tape cassette 10B is received by these receiving pins 72a, 72b.

Figs. 5 and 6 show the interior structure of a portion of the thin tape cassette 10A and the thick tape cassette 10B respectively, when received in the cassette accommodation unit 50. A roller cam 76a or 76b provided on the inner circumference of the lower end of the tape drive roller 34a or 34b respectively is engaged with a drive cam 78 provided on the outer circumferential surface of the tape drive shaft 56 of the tape print device 40. A drive gear 80 disposed at the base end of the tape drive shaft 56 of the tape print device 40 is engaged with a follower gear 84 provided at the base end of the tape feed roller 62 supported by the roller holder 82. In use, the tape feed roller 62 is pressed against the tape drive roller 34a or 34b of the tape cassette 10 (10A or 10B) through the roller presser 86 by springs 88 provided on the roller holder 82. In use, by rotating the drive gear 80 and follower gear 84, the adhered tape T, which is held between the rubber roller 90 covering the tape drive roller 34a

or 34b and the rubber roller 92 covering the tape feed roller 62, is fed along a feed path.

As shown in Figs. 7 and 8, in the case of both the thin tape cassette 10A and thick tape cassette 10B, the spool cam 93a or 93b respectively, provided on the inner circumferential surface of the ribbon spool 30a or 30b respectively, is, in use, engaged with the drive cam 95 provided on the outer circumferential surface of the ribbon winding shaft 54 of the tape printing device 40. A ribbon drive gear 98 is loosely fitted to the outer circumference at the base portion of the ribbon winding shaft 54 and coupled with a motor 102 through a gear train 100.

A clutch spring 104 is disposed around the outer circumferential surface at the base portion of the ribbon winding shaft 54. The clutch spring 104 is composed of a coil slidably wound around the outer circumferential surface at the base portion of the ribbon winding shaft 54 in the state that it is in pressed contact therewith. The other end of the coil is locked to the locking piece 106 disposed on the surface of the ribbon drive gear 98. With this arrangement, any difference between the rotational speed of the ribbon drive gear 98, transmitted from the motor 102, and the rotational speed of the ribbon winding spool 30 (which changes as the winding diameter of the ink ribbon 22 wound around the ribbon winding spool 30 changes) is absorbed by slippage between the ribbon winding shaft 54 and the clutch spring 104. Winding of the ink ribbon 22 relies on the frictional force between the clutch spring 104 and the winding shaft 54 to transmit drive.

Frictional torque is produced from the printing device through the clutch spring 104, the required torque varying depending on the width of the ink ribbon 22. A small torque is insufficient to wind the ink ribbon 22, but, when too large a torque is applied, the ink ribbon 22 may be broken. In the arrangements shown in Figs. 7 and 8 the frictional force produced through the clutch spring 104 is set to a value sufficient to wind the ink ribbon 22 of the thick tape cassette 10B.

In the case of the thick tape cassette 10B in Fig. 8, it will be noted that the ribbon winding shaft 54b is engaged with the spool cam 93b of the ribbon winding spool 30b over the entire length thereof.

In both the thin tape cassette 10A and the thick tape cassette 10B, a spool spring 94 is provided to the ribbon winding spool 30a or 30b respectively. An end of the spool spring 94 is locked to the locking piece 96 on the lower cover case 14. The spool spring 94 in the thick tape cassette 10B is used to prevent the ribbon winding spool 30b from rotating due to vibration or the like and has a small frictional load. On the other hand, the spool spring 94 of the thin tape cassette 10A has a large frictional force.

The spool spring 94 applies a frictional torque to the ribbon winding spool 30. This frictional torque acts against the torque transmitted via the clutch spring

104 to the ribbon winding spool 30 and thus reduces the net winding torque applied to the ink ribbon 22. As a result, even a narrow ink ribbon can be normally wound without being broken. Therefore, tape cassettes of differing widths can be used in a single printing device without problem.

As will be apparent from the above description, the cassette mounting structure in the illustrated embodiment of printing device enables tape cassettes of different thicknesses, including a thick tape cassette and thin tape cassette, to be received in the cassette accommodation chamber and used.

Furthermore, because the thin tape cassette is positioned at the outer side of the cassette accommodation unit, it can be easily attached/detached and when the tape cassette is received in the unit there is less chance that the ink ribbon of the tape cassette will be caught by the print head and damaged and the surface of the print head stained.

Moreover, when tape width, tape color, amount of tape remaining of a tape cassette etc. are confirmable through the sight window of a cassette cover covering the cassette accommodation unit, they can be easily confirmed because the top surface of the thin tape cassette is mounted near the cassette cover. Thus, the illustrated embodiment of tape cassette mounting structure provides various practical advantages and is also very convenient to use.

Whilst the illustrated example shows cassettes of two different thicknesses, it will be appreciated that the present invention is applicable to a range of greater than two cassettes of different thicknesses.

Furthermore, whilst in the illustrated embodiment of cassette the cassette is illustrated as containing a recording tape, an ink ribbon and an adhesive tape, the cassette may comprise other numbers of tapes, including a single tape or two tapes. For example, the cassette may contain only a recording tape on which the image is to be printed by other than ink. Alternatively, the cassette may accommodate a recording tape in combination with either an ink ribbon tape (which is not fed from the exit aperture) or an adhesive tape (which is fed from the exit aperture with the recording tape). The above are non-exhaustive examples of tape permutations and are not to be regarded as limiting.

Claims

1. A printing device comprising a cassette accommodation chamber in which a tape cassette, containing a tape-like member, is detachably receivable, said cassette accommodation chamber having a bottom surface and an entrance opening opposite to said bottom surface and said cassette accommodation chamber being arranged to receive tape cassettes of at least two different

thicknesses, said printing device further comprising cassette positioning means provided in said cassette accommodation chamber for cooperating with a cassette received in said chamber to position the received cassette in said chamber, wherein when the received cassette is the thinner of said at least two different thickness tape cassettes a base surface of the thinner cassette facing said bottom surface is spaced from said bottom surface by a greater amount than the spacing between said bottom surface and the corresponding base surface of the thicker of said at least two different thickness tape cassettes when the thicker tape cassette is the received cassette.

2. A printing device as claimed in claim 1, wherein said cassette positioning means comprise means projecting into said cassette accommodation chamber.
3. A printing device as claimed in claim 1 or claim 2, wherein said cassette positioning means comprises at least one projection extending from said bottom surface of said cassette accommodation chamber in the general direction of said entrance opening.
4. A printing device as claimed in claim 3, wherein a free end of said at least one projection is arranged to contact the base surface of the thinner cassette when the thinner cassette is the received cassette.
5. A printing device as claimed in claim 3 or claim 4, wherein a free end of said at least one projection is arranged to be received in a recess provided in the base surface of the thicker cassette when the thicker cassette is the received cassette.
6. A printing device as claimed in claim 5, wherein said free end of said at least one projection is arranged to contact the base of said recess when the thicker cassette is the received cassette.
7. A printing device as claimed in any of the preceding claims, wherein said cassette accommodation chamber comprises side walls and said cassette positioning means comprise at least one step portion provided by a said side wall.
8. A printing device as claimed in claim 7, wherein said at least one step portion includes a top surface facing in the general direction of said entrance opening.
9. A printing device as claimed in claim 8, wherein said top surface of said at least one step portion

is arranged to contact the base surface of the thinner cassette when the thinner cassette is the received cassette.

10. A printing device as claimed in claim 8 or claim 9, wherein said top surface of said at least one said step portion is arranged to be received in, or to receive, a corresponding step provided in or on the base surface of the thicker cassette when the thicker cassette is the received cassette.

11. A printing device as claimed in claim 10, wherein said top surface of said at least one step portion is arranged to contact the facing surface of the corresponding step of the thicker cassette when the thicker cassette is the received cassette.

12. A printing device as claimed in any of claims 7-11 when dependent on any of claims 3-6, wherein both said at least one projection and said at least one step portion are arranged to contact and support the thinner and/or thicker cassettes when either the thinner or thicker cassette is the received cassette.

13. A printing device as claimed in any of the preceding claims, wherein the cassettes to be received in said cassette accommodation chamber include a top surface, arranged to face in the general direction of said entrance opening of said cassette accommodation chamber when received in said cassette accommodation chamber, and said cassette positioning means are arranged to position the received cassette in said cassette accommodation chamber such that the top surface of the received cassette is located substantially in the same position regardless of whether the received cassette is the thinner or the thicker cassette.

14. A printing device as claimed in any of the preceding claims, wherein the cassette to be received in said cassette accommodation chamber include a top surface, arranged to face in the general direction of said entrance opening of said cassette accommodation chamber when received in said cassette accommodation chamber, the printing device further comprises a printing head protruding from said bottom surface of said cassette accommodation chamber in the general direction of said entrance opening, and said cassette positioning means are arranged to position the received cassette in said cassette accommodation chamber such that the printing head is positioned below the top surface of the received cassette regardless of whether the received cassette is the thinner or thicker cassette.

15. A cassette for use with the printing device

claimed in any of the preceding claims, the cassette comprising means arranged to cooperate with the cassette positioning means of the printing device, when the cassette is received in the cassette accommodation chamber, to position the cassette, the arrangement of these cooperating means being dependent on the thickness of the cassette.

16. A combination of a printing device as claimed in any of claims 1 to 14, with at least two cassettes as claimed in either claim 15 or claim 16, said at least two cassettes being of different thicknesses.

17. A tape cassette for use with a tape printing device, the cassette being arranged, in use, to be received in a cassette accommodation chamber of the printing device, the tape cassette comprising a case, a tape-like member contained in the case and means for positioning the cassette in the cassette accommodation chamber, the orientation of said means for positioning being dependant on the thickness of the cassette and being selected whereby regardless of the thickness of the cassette the surface of the cassette that is arranged, in use, to face out of the cassette accommodation chamber is positioned in substantially the same location as the corresponding surface of another cassette of different thickness when the another cassette is received in the same cassette accommodation chamber.

18. A printing device or tape cassette as claimed in any of the preceding claims, wherein the tape-like member is an ink ribbon.

FIG. 1

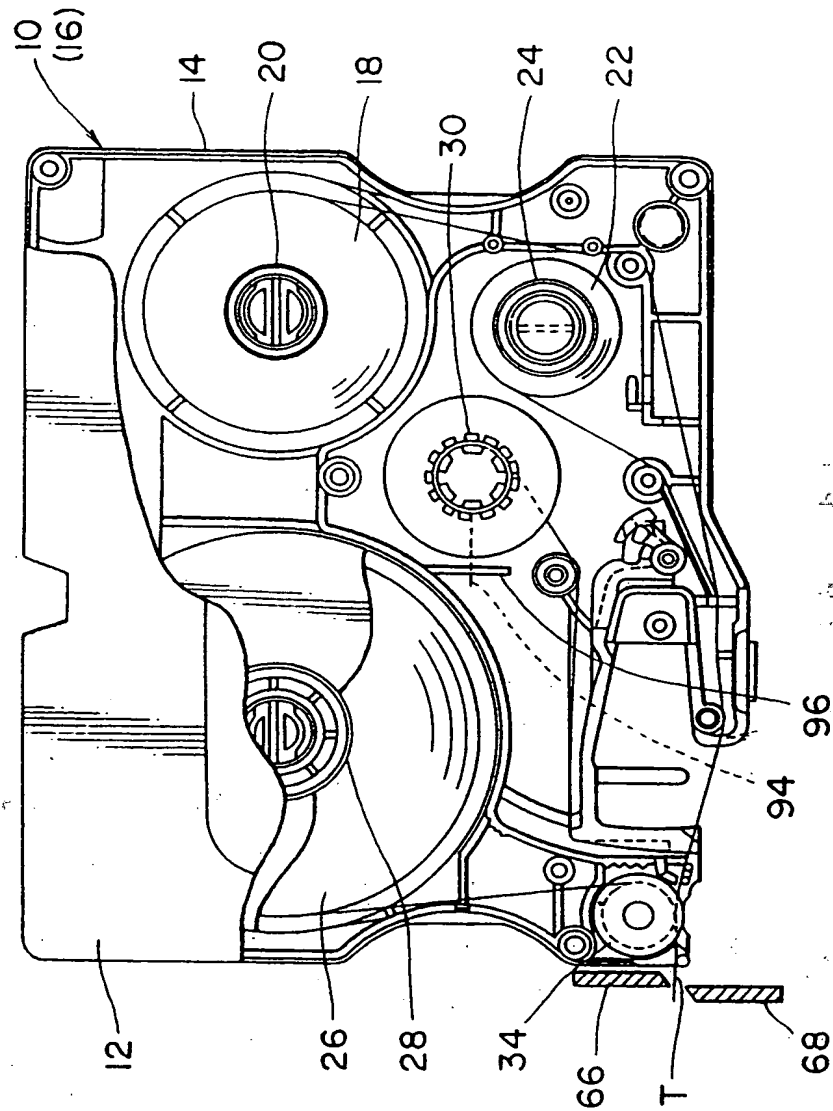


FIG. 2

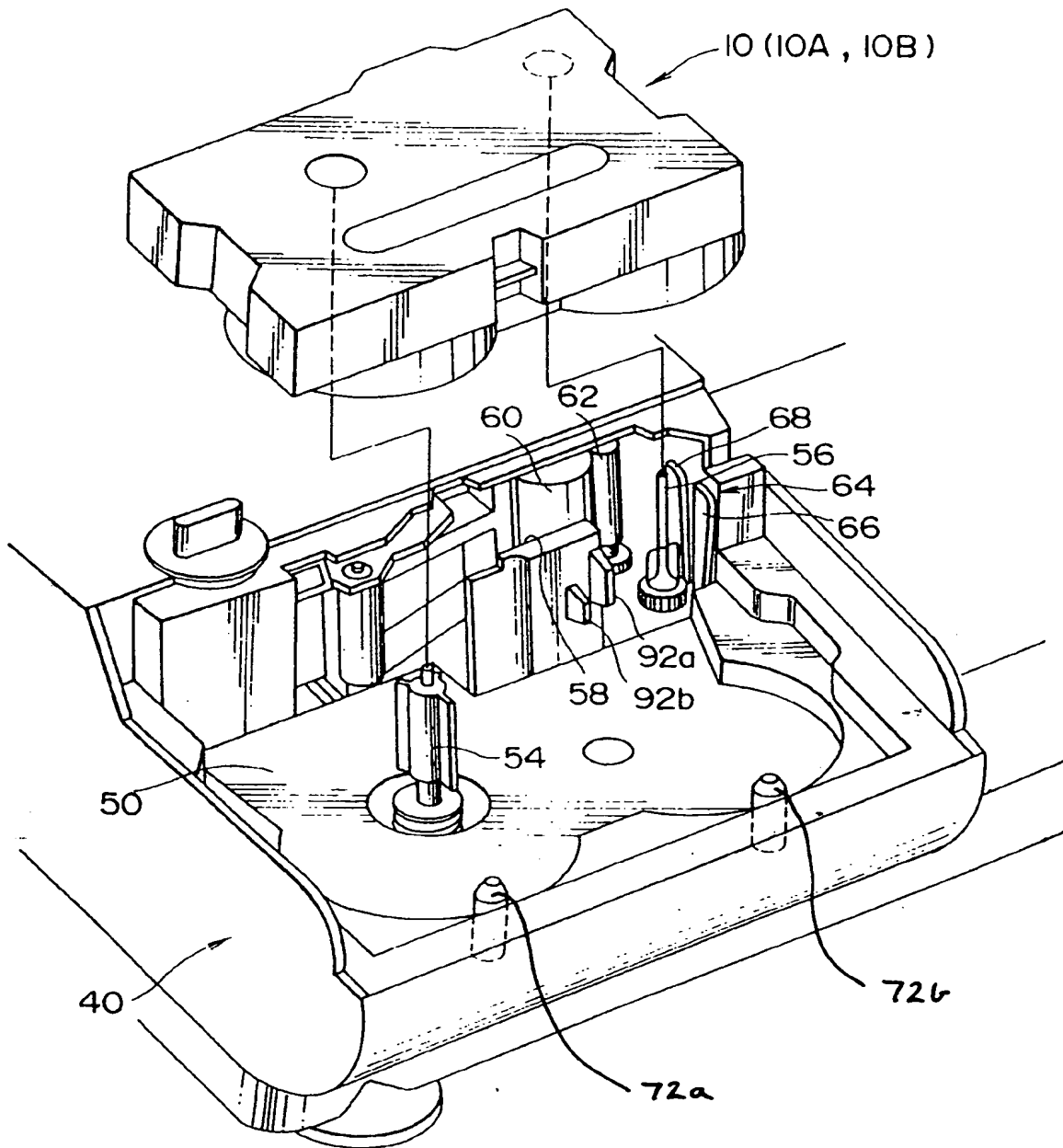


FIG. 3

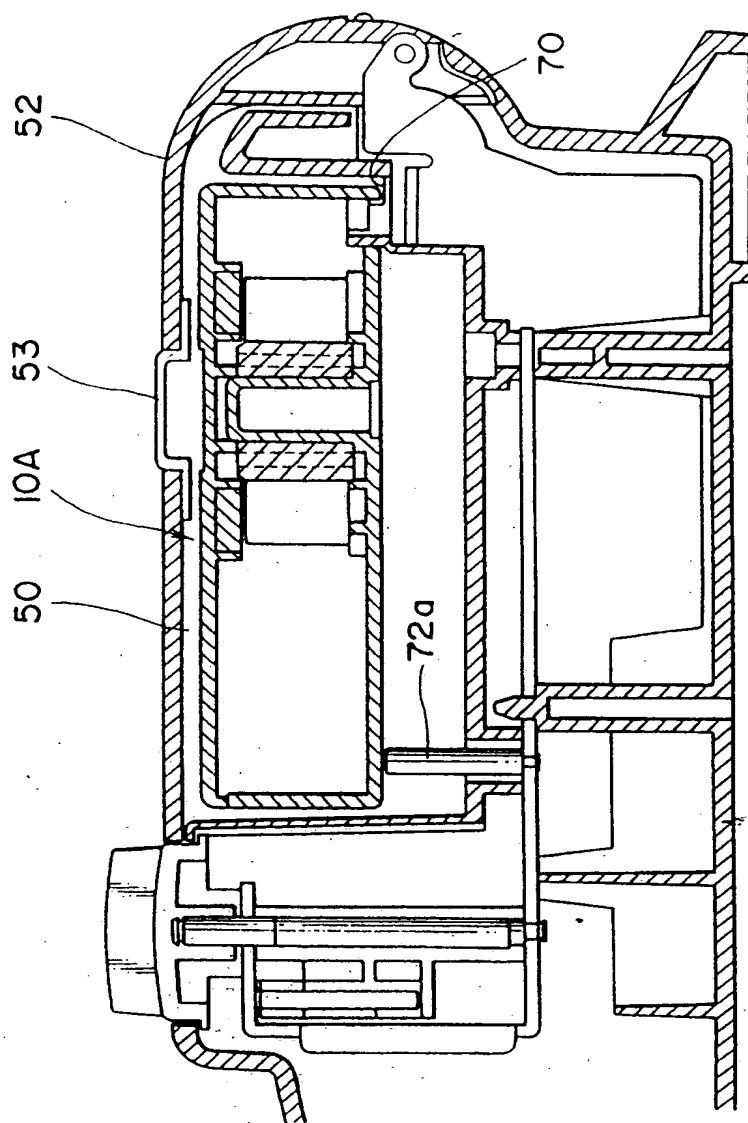


FIG. 4

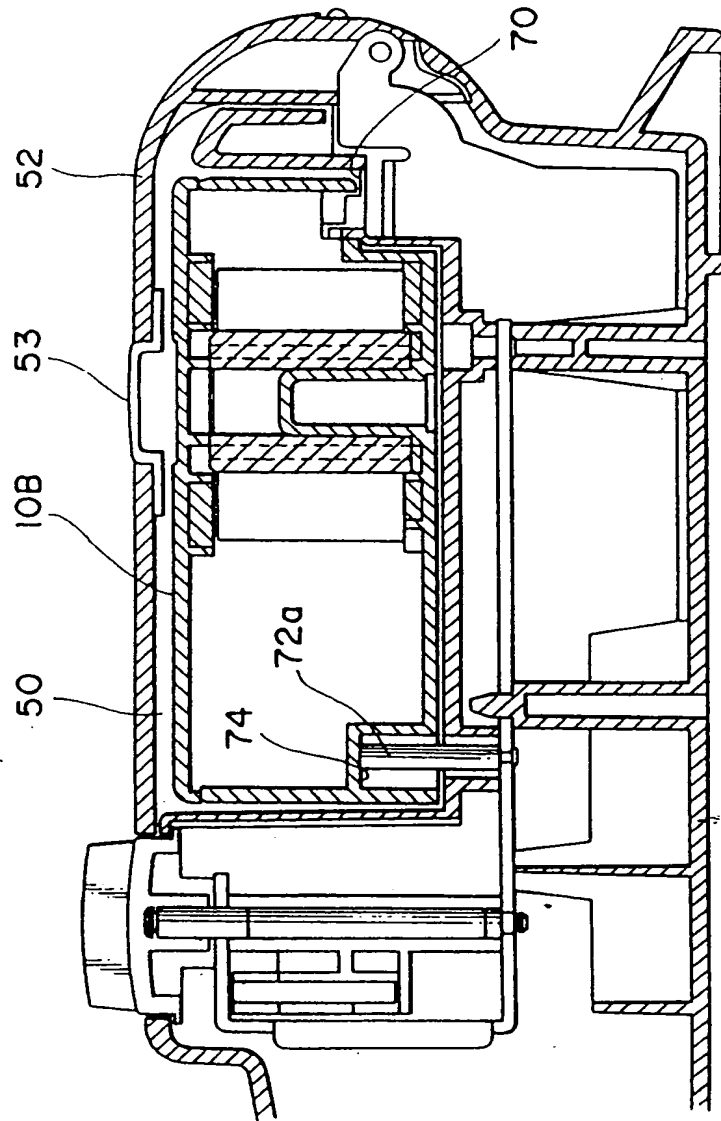


FIG. 5

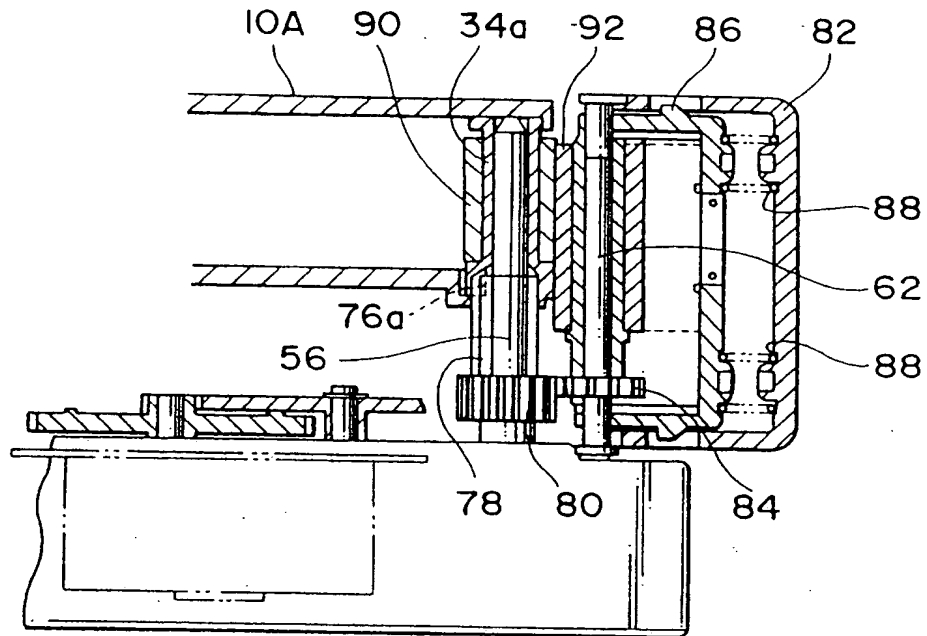


FIG. 6

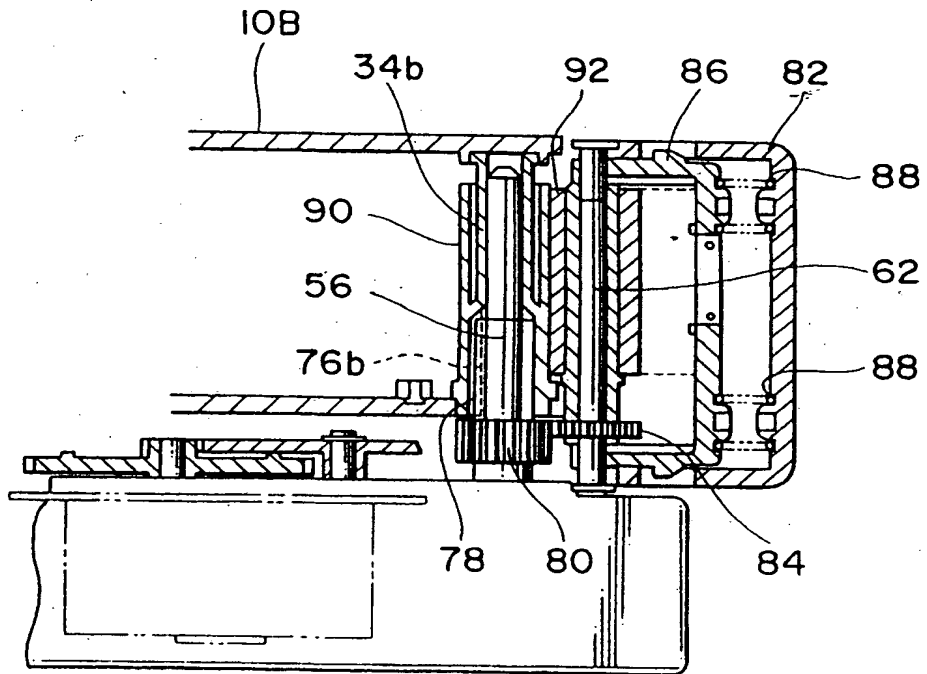


FIG. 7

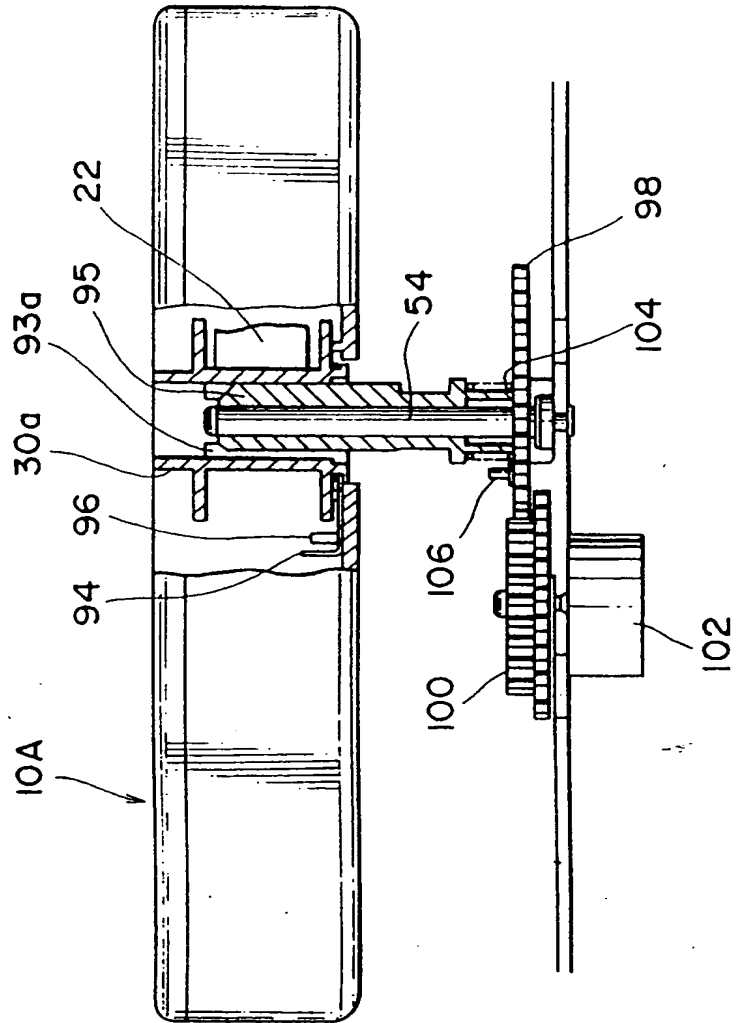


FIG. 8

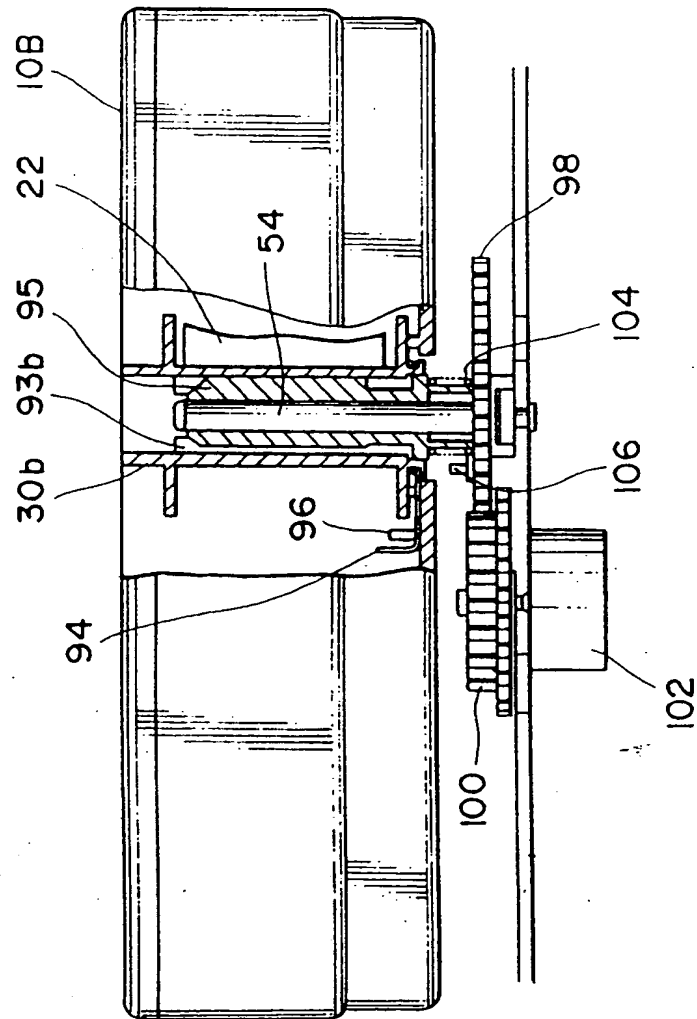


FIG. 9

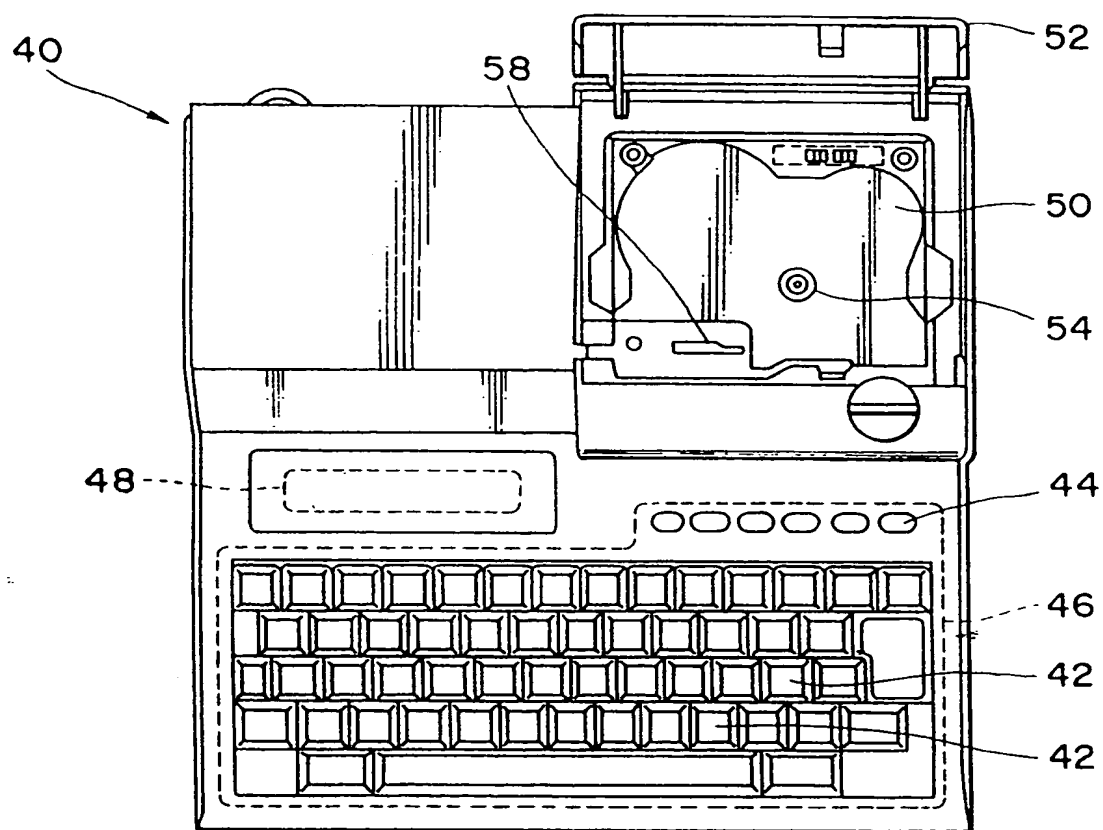
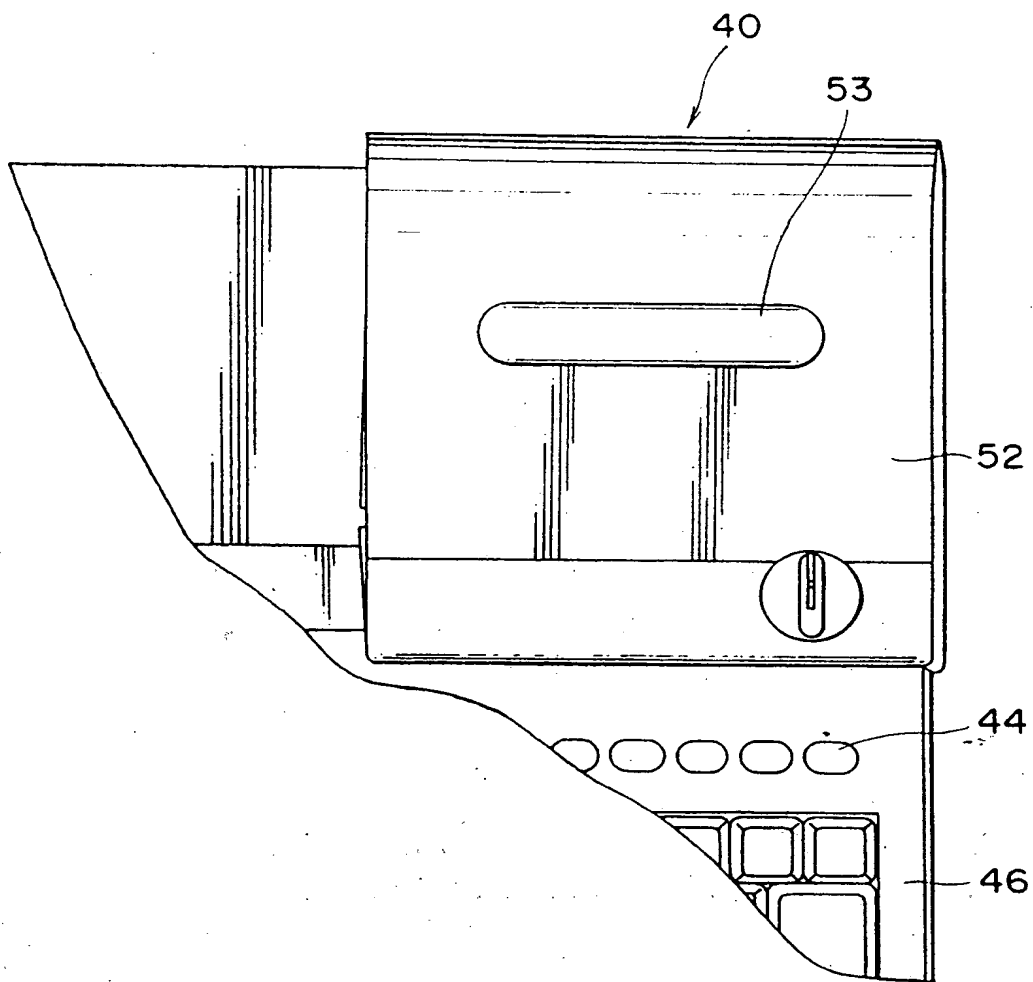


FIG. 10



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